

PSP Inaugural Meeting

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Flux ramp up

FY.	19	20	21	22	23	24	25	26	27	28	29	30
10^{12} p/pulse	4.2	4.2	4.4	4.6	4.8	4.8	4.8	> 6.5				
Flux (10^{17} p/hr)	2.4	2.4	2.5	2.6	2.7	2.7	2.7	3.2	3.2	3.2	3.2	3.2

PIP1+



PIP II era

Mary expects 1 MW target end of FY20.

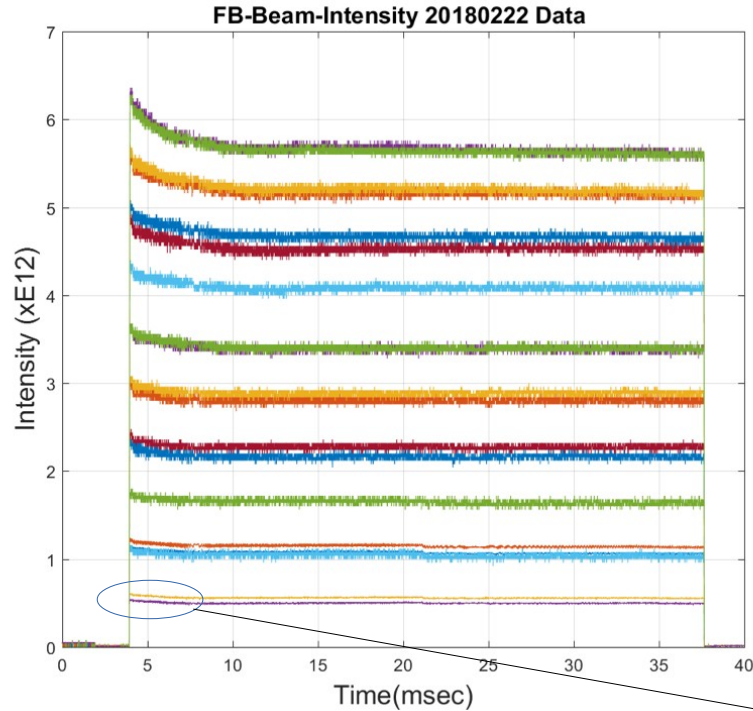
FY19-25: 15 Hz operation with 5% overhead ($x \cdot 15\text{Hz} \cdot 3600\text{s} / 0.95 == \text{flux}$) (0.95: 5% overhead)

FY25: PIP II era begins. Assume 20 Hz operation

How do we get to PIP1+ goal of 900 kW?

- We need to get from $4.2\text{e}12$ to $4.8\text{e}12$ at extraction. (14% more beam)
- $4.5\text{e}12$ at injection (present) to $5.0\text{e}12$ (assuming 5% loss)
- We have to maintain losses $< 500\text{ W}$
- We cannot increase losses by 14%.

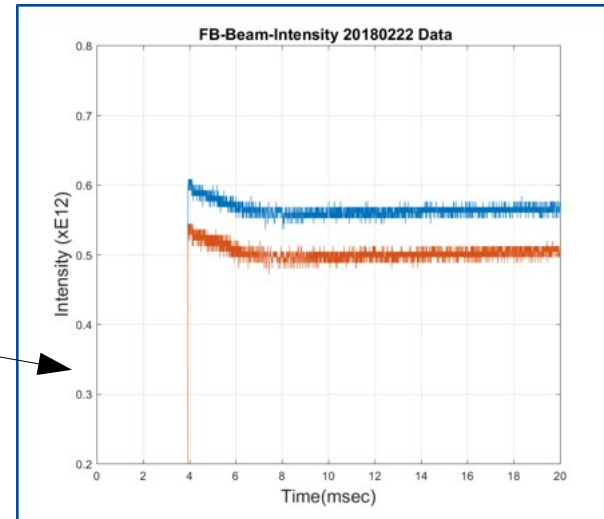
Losses at injection has to be fixed



Our suspicion is that the problem is longitudinal and has something to do with RF.

There is beam loss at 4 – 6 ms in the cycle. Time scale for this loss is about 2 – 3 ms after injection.

We see this loss even at low intensity $< 0.6e12$, $\sim 5\text{-}6\%$. And this loss is similar to high intensity! Therefore, this is **not** a space charge problem.



Simulations show that this loss should NOT happen!

So why?

Short term plans

- Fixed RF phase errors (see Victor's talk)
 - This has already yielded dividends, switching from one RF station to another requires much less tuning than before.
- Continue work on adiabatic capture
 - DC ramp studies show that we have settings that we know how to do adiabatic capture.
 - Chandra is continuing looking at adiabatic capture during HEP. With the phase errors corrected:
 - Initial studies show that capture at 92% level for 18 turns 5.2×10^{12} at injection.
 - More RF errors to be examined.
- Flat injection porch is being worked on
 - Bill, Howie and Chris have been looking into this for a long time.
 - Plan is to use dipole correctors to flatten B-field at injection.
 - Hope to demonstrate this early next year.

Projects that support short term, PIP1+ and PIP2

Machine	Description	i/c	Goal
Pre-Acc	Build Penning source. This is with RAL (under MOU). RAL is sending parts for Penning source. Postdoc hired.	Dan	To make CW source that is PIP II compatible.
Pre-Acc	Laser collimation of head/tail of longitudinal beam. (LDRD)	Dave	Reduce halo losses in Booster. PIP I+ and PIP II.
Pre-Acc/ Linac	Simulation of PreAcc + Linac	Valeriy/ Kiyomi/Dan	Understand optics and possible improvements in PreAcc
Linac	Halo removal with collimators. Improve mechanism in 750 keV collimators 400 MeV collimators? (PIP1+)	Kiyomi	Reduce halo losses in Booster.
Booster	Flat injection porch	Bill	See if we can make a flat injection porch with correctors. Adiabatic capture is understood and demonstrated with DC ramp measurements. PIP II test.
Booster	Adiabatic capture	Chandra	Continue with one shots to understand adiabatic capture.
Booster	2 nd harmonic	Robyn/Tan	Flatten injection bucket. Waiting for high power test.
Booster	Wide bore cavities	Salah/Matt	Increase aperture. (3.0 inches compared to 2.25"). In build process.
Booster	2 stage collimators	Valeriy	Improve collimation in Booster. PIP1+.
Booster	Injection girder	Dave	800 GeV injection girder. PIP II.
Booster	Garnet loss improvements	Robyn/Tan	LDRD (PIP2 and beyond). In 2 nd stage approval process. In partnership with industry (NMG).
Booster	Mode 2 longitudinal damper	Nathan	Requires new broadband cavity. Also need specs. (benefits PIP1+)
LLRF	GMPS machine learning (get rid of reference magnet)	Bill	LDRD (PIP1+) In 2 nd stage approval process
LLRF	Complete DDS upgrade, paraphase controller	Brian	Short term (benefits PIP1+)
LLRF	Upgrade LLRF of klystron and LE mfc test stands	Brian	Short term (benefits PIP1+)

House keeping

Machine	Description	i/c	Comments
Linac	7835	Kiyomi	Consumable. 3-4 tubes replaced each year.
Linac	Klystron	Kiyomi	Refurbishment. Still under negotiation
Linac	Beam instrumentation	Kiyomi	Example: Real time bunch length monitor, TOF system etc.
Booster	BPM	Salah/Peter	Progress with BPMs. Still has problems ...

PSP

- PSP will be run like PIP (but not as an official campaign or project)
 - PIP has been very successful. A good model to follow
 - We need to keep track of all the work that is done in PS.
 - There will be small subgroups (projects listed on previous slides) and report during PSP meetings.
 - PSP will have regular meetings and updates to keep everyone informed of progress towards 900 kW.
 - Meetings will every 2 weeks.

Plans

- For the next few years our goal is to improve PS for reliable 900 kW operations
- RF fixes (HLRF, LLRF)
 - Paraphase tuning for adiabatic capture has yielded better efficiencies ~91 to 93% efficiency @5e12 after RF phase fixes.
- Flat injection porch
- Better collimation to control loss points in both Linac and Booster.
- Better H- source to improve beam quality.
 - Better simulation of Pre-Acc to understand whether any improvements are possible.

